WHATEVER HAPPENED TO THE ANCIENT RIVERS OF THE EASTERN CAIRNGORMS?

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Many of you will be familiar with the feeling of relief as you emerge from the glen and the gradient under your feet suddenly lessens, with the promise of the summit plateau not far distant. This is called the 'break of slope'. It is significant not only for the walker on the day but for our understanding of the ancient rivers of the Cairngorms and the landscape through which they flowed.

Before the arrival of the now familiar granite, this whole area was covered in sea, with sediments accumulating between 750 and 500 million years ago. Then came the Caledonian mountain building epoch: compressive forces raising these sediments to great heights, akin to the Alps or Himalayas of today. Deep within these mountains, great reservoirs of magma formed, either from the rocks round about melting, or by coming up from the earth's crust below. The magma cooled to form into granite at a depth of not less than 7km, to create the familiar crystal mosaic of quartz, feldspar and mica, 427 million years ago. These mountains (the 'Caledoniades') were then eroded down to their roots. At this point the land was once again submerged and covered by deep marine sediments such as the Old Red Sandstone, eroded from the upper slopes of the Caledoniades. This landscape once again rose above the waves and these more recent sediments were largely removed by erosion to reveal the granite roots of the original mountains. Today we can still see the remains of these more recent sediments around the edge of the Cairngorms on the Moray coast and the Mearns. As the granite became unroofed, it in its turn became subject to erosion, facilitated initially by ancient rivers and later by ice.

The Cairngorm plateau was formed of this giant intrusion of magma deep into the pre-existing rock, the Dalradian.[1] As we walk over it, we are crossing the top of the magma chamber, now devoid of its overlying strata. The primary drainage was west to east from a watershed at the western and northern edge of the Cairngorm plateau and the headwater streams on the Gaick, Braeriach and Macdhui-Cairngorm plateaux today, have hardly changed from pre-glacial times.

These ancient rivers flowed through broad, mature valleys at about 600m (2000ft). Even then, they would have been recognisable as

approximating to today's Dee and Don. Over several episodes of Ice Age during the past 2.6 million years, the area would have been deeply covered by a thick ice cover.

In today's post-glacial landscape, the break of slope separates valley from plateau glaciation. Valley glaciation followed the course of the ancient rivers, creating the glens we recognise today by gouging out huge volumes of rock and sediment. Plateau glaciation was quite different. The plateau was occupied by an almost static and protective ice which moved slowly into the heads of the valley glaciers. On the plateau, little glacial erosion took place. So, today's plateau landscape has changed little since pre-glacial times and, crucially, it was through this same landscape that the ancient rivers flowed. Indeed, their headwaters still do.

So, as your weary limbs gain some respite, remember that you are now walking on an ancient landscape in places little changed from pre-glacial times. Ahead of you lies the Cairngorm plateau, punctuated by smooth tops and magnificent peaks. Viewed from a distance, the whole Cairngorm massif blends into a high tableland, albeit deeply dissected by today's corries and valleys. Turn and look behind you across the valley from which you have just emerged. Imagine the slope on which you stand gently curving to the same height on the opposite side of the glen (Fig1, see next page). This would approximate to the cross-section of the ancient valley containing a riverbed at say 600m (2000ft), several hundred feet above today's stream. This extrapolation also gives us some idea of just how much material has been removed.

As these huge valley glaciers moved east, they filled and deepened the valleys of the ancient rivers, often spilling over watersheds into adjacent basins. Ice passing over a lateral col in this way is known as a 'glacial breach' - the critical event predisposing to later river diversion, when the main stream is diverted onto a new path. All the ancient rivers of the eastern Cairngorms fell victim to this process. The concept of glacial breach leading to river diversion depends on erosion of a suitable col. Once the ice spilled over the top into the neighbouring basin, it would begin to incise and erode the watershed. Meltwater would follow during several periods of warming and the combination, perhaps over multiple phases of glaciation, would lower this watershed to a point that offered a real alternative for the main stream to divert to

lower ground. This process would be exacerbated if there was a hold up to the flow of ice down the main valley further down.

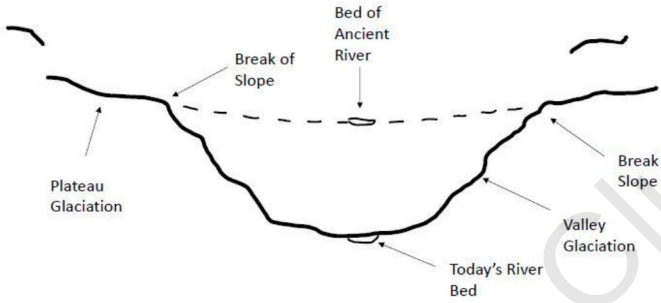

Fig 1. Diagrammatic cross section of a glaciated valley.

The power of meltwater during the melting of the ice sheet and retreat of the valley glaciers might be guessed at by the plethora of meltwater phenomena in the Dee and Don basins e.g. Burn o'Vat, the river terraces of Glens Geldie and Tilt, the massive outwash deposits in the lower Feshie and as we will learn, the spectacular Ailnack Gorge. The last Ice Age was terminated about 11,000 years ago by a sudden rise in global temperature of 7 degrees Centigrade over a period of only 50 years – a human lifespan.

The river diversion resulting from glacial breach should be distinguished from river capture. In the latter one stream, usually steep and rapid, erodes into the hillside towards its source and gradually intercepts the drainage system of a neighbouring stream and so 'beheads it'. In contrast, glacial breaching starts with ice passing over a col, which develops into a gorge lower than the main valley, and so the main river is diverted, following the direction of flow of the ice that originally crossed the col.

In this article I would like to address the development and demise of the ancient rivers Dee and Don over territory well known to members. The general area can be seen in Fig 2, (see next page). It might be helpful to follow the text with OS Landranger series numbers 35, 36, 42

and 43 which will give more detail. Let's start with the Ancient River Dee (ARDee).

The headwaters of the ARDee can be seen today in the streams of the Gaick plateau, west of today's upper Feshie. The streams there, above 500m (1650ft), are pretty well unchanged from 11,000 years ago, and give us some idea of the height of the original watercourse. The ARDee followed the line of the upper Feshie, then the Geldie Burn and so to the present line of the Dee below White Bridge (sometimes referred to as the Feshie-Geldie-Dee). Today its continuous and obvious valley links the sections of these rivers.

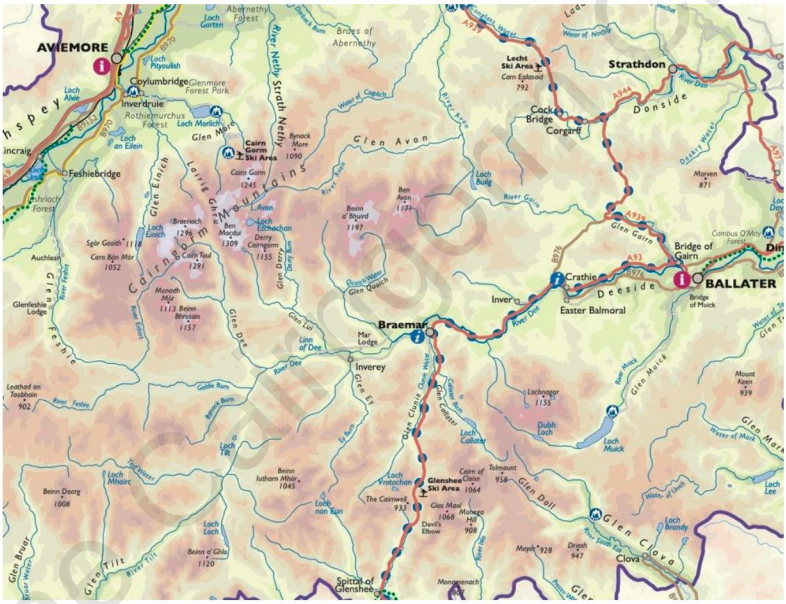

Fig 2. The Cairngorm Mountains including the areas mentioned in the article. Map © Ashworth Maps and Interpretation Ltd 2019.
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The watershed between the ARDee and the Feshie lay not at the elbow of the latter (NM914873), as we find today, but six miles to the north-west at the level of today's Feshie Gorge between Creag na Gaibhre to the north and Creag na Caillich to the south (NH854905) (Fig 3, see next page).

South and east of this watershed a small stream flowed towards the ARDee, collecting on its way the R. Eidart. The confluence of these

two indicates a former flow to the south-east. This combined stream probably joined the ARDee at the Feshie elbow (where today's Feshie swings from west-east to southeast-northwest), reversing the flow of the original tributary from the col as the post glacial River Feshie exploited the gap created by the glacial breach. In Fig 3 below, in the view from the west, there may be discerned an obvious break of slope around 670m (2200ft) (A & D) gradually falling to the south-east at about 550m (1800ft) (B & C). These points form part of the line of the original valley sloping towards the ARDee, in contrast to the north-west flowing Feshie today.

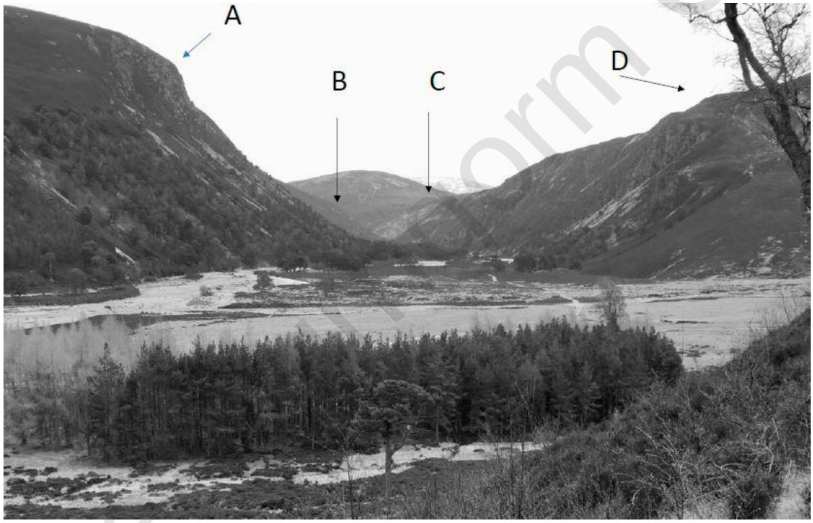

Fig 3. The Feshie Gorge from the west, showing breaks of slope at the col A & D and further down the original tributary valley of the ARDee at B & C. Carn Eadar is seen snow covered in the background behind C.
Picture from NN840921 R. Jowett.

The Feshie's dramatic elbow comes within a few feet of the feeders of the Geldie off Carn Eadar. At its elbow, the Feshie, energised by the opening up of a lower route to the sea, dug into the morainic deposits at the elbow, and thus was separated from the Geldie. This is today's watershed. The walk up the Geldie from White Bridge can be tedious with little in this fading burn to engage the interest. Then in the distance a much larger stream fills the valley and roars over its rapids as it

reaches the elbow. The Feshie makes a grand entrance to the common valley - the valley of the ARDee – then makes a sharp exit to the north-west. The contrast between the two streams couldn't be greater.

Walking up the Dee valley towards White Bridge, it is clear that while the main valley lies ahead to the west, occupied by the Geldie, the Dee emerges from a narrow side valley from the north – Glen Dee. Confirmation of latter's subsidiary origin is found at the Chests o' Dee, where the upper Dee plunges down from its higher valley floor to reach that of the Geldie in its more mature valley – that of the ARDee. The upper Glen Dee is a 'hanging valley' and other examples in the area include the Lui, Quoich, Ey and Cluny. In each case the larger, heavier Dee glacier truncated the tributary valleys, leaving the confluence 'hanging'. Ice accumulated to great depths in the Garbh Choire (NH956985) and at a faster rate than could be taken by the lower Glen Dee outlet. Ice sought a place to breach and found it to the north in the Lairig Ghru at Pools o' Dee – another classic glacial breach. Despite this breach to the north, there was enough ice coming down Glen Dee to dominate the dynamics at White Bridge, obstructing the ARDee glacier as it came in from the west and the Ancient River Tarf (ARTarf) glacier coming from the south. As a possible consequence we have the Feshie breach and the one at Forest Lodge in Glen Tilt (see below). Elements of a break of slope on both sides of Glen Geldie can be discerned – part of the original ARDee valley floor.

To the south of the Geldie section of the ARDee lies the R. Tarf, which flows through a wide strath lying west to east, before originally swinging north to join the ARDee just to the north of Bynack Lodge. However, the R. Tarf no longer occupies the final section of its strath but turns sharp south to join today's R. Tilt (NH983796). Walking south it is clear that you're following a groove that crosses the wide west-east strath to enter a slit that is Glen Tilt. Looking ahead of you to the south, as you approach the Belford Suspension Bridge, a wall of hills closes in towards Glen Tilt on either side. This represents the southern boundary of the original strath of the R. Tarf, before it was incised by the Tilt. Here the hills on either side of the Tilt slope towards the Dee rather than the Tilt (Fig 4, see next page), confirming the dominance of the original Dee drainage in this area.

The original watershed in Glen Tilt would have been about 1km above Forest Lodge (NH933741), between Carn a' Chlamain in the west and Beinn a' Ghlo in the east (Fig 5, next page)

Fig 4, Picture taken from the shoulder of An Sligearnach, at NN966781, looking east, showing the southern edge of the ARTarf basin as it turns north to the ARDee. The defile in the middle distance, arrowed, with the tree, is the valley of the Tilt, incising the southern slope of the ARTarf basin.

South of this the southern Tilt (Tilt S) would have existed, while a northern stream (Tilt N) would have been its companion on the other side of the divide, flowing towards the ARDee and collecting the Tarf, the Allt an Ruigh Ghil, the Allt a' Ghlinne Mhoir and An Lochain on its way. Normally a tributary merges with the main stream at an angle of less than 90^0, i.e. pointing downstream. The junctions of all these tributaries with the Tilt today are abnormal, turning more than 90^o to the larger river, and indicating an originally northerly facing confluence.

Passing down Glen Tilt towards Forest Lodge many of the small tributaries drop almost directly down from the divided col above, that is, from the pre-glacial plateau. Their trend is northwards above the

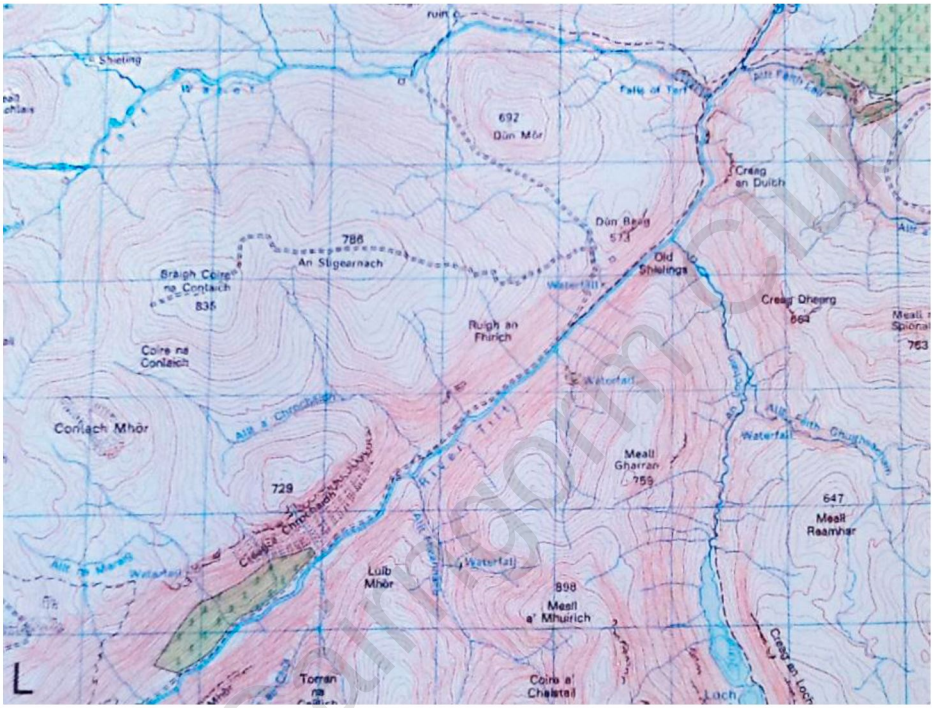

Fig 5. Glen Tilt. The original watershed is about 1km north of Forest Lodge. South of this the tributaries join the main stream in the normal way, i.e. pointing downstream, while north of Forest Lodge, their courses trend northwards as they approach the main stream. From Landranger 43 © Crown copyright, 2119 OS Licence 100061712.

lodge and southwards below it. The original col here is estimated to have been around 550m (1800ft).

The breach in Glen Tilt would have been encouraged by the obstruction of ice flow along the Tarf towards the Dee resulting in some of this ice being pushed over the col at Forest Lodge, followed by associated melt water. In addition, the geology of the valley is a shatter zone of limestone and soft black schists which would have afforded less resistance to the powerful push south towards the R. Garry. Below Forest Lodge there are several well-developed terraces which reflect

episodes of high-volume flow, with the river digging through its former bed and leaving shoulders on each side.

Strath Tarf is always something of a surprise with its broad valley floor and evident maturity. The floor of the glen is between 490-670m (1600-2200ft) and the headwaters are 9 miles to the west. Indeed, the valley extends even further west of the present headwaters of the Tarf on the northern slopes of Beinn Dearg, territory occupied by the Tromie and Bruar. This is hardly surprising since the pre-glacial watershed of the Cairngorms was even further west, overlooking the Spey. In Strath Tarf, the break of slope on either side is at about 600m (2000ft). Where this forms a continuous 'bench', it gradually merges with the Gaick plateau and the Tarf headwaters to the west and is the little changed valley floor of the Ancient River Tarf (ARTarf). At its east end, the river today tumbles over the Falls of Tarf to reach the Tilt 60m (200ft) below. Walkers who stick to the delightful riverside walk towards the Tilt will miss the grandeur of Strath Tarf above them to the west.

As a result of glacial breaching and the consequent diversion of the upper ARDee into the Feshie and the ARTarf into the Tilt, the Dee catchment was reduced by 163 square miles. While the present R. Dee catchment has been reduced considerably, losses of the Don catchment were also significant, some 60 square miles.

Turning now to the Ancient River Don (ARDon). The original headwaters lay on the Cairngorm plateau around Loch Avon (and the streams are still there). It flowed along the line of today's Loch Avon and upper Avon as far as Inchrory, then continued east along the valley of the present R. Don, but a few hundred metres above its present level. That this is a single mature valley is as plain on the ground as it is on the map. What happened at Inchrory to make the upper ARDon turn north into the Avon valley? (Fig 6, see next page). Once again perhaps a mere hesitation in the progress of the ARDon glacier forced ice to breach the col to the north, sending ice pouring over into the Avon and secure a faster route to lower ground north of Inchrory.

Added to this there was to the south another glacial breach, this time contributing to the pressure of ice above Inchrory. Ice from the southern slopes of Beinn a' Bhuird and Ben Avon filled Glen Gairn which had a limited outlet to the south. A flow of south to north ice through the Builg gap resulted. As we found with the Tarf, local geology including

faults, limestone and black schists in the Avon below Inchrory no doubt helped but was very much subsidiary to the primary effect of ice.

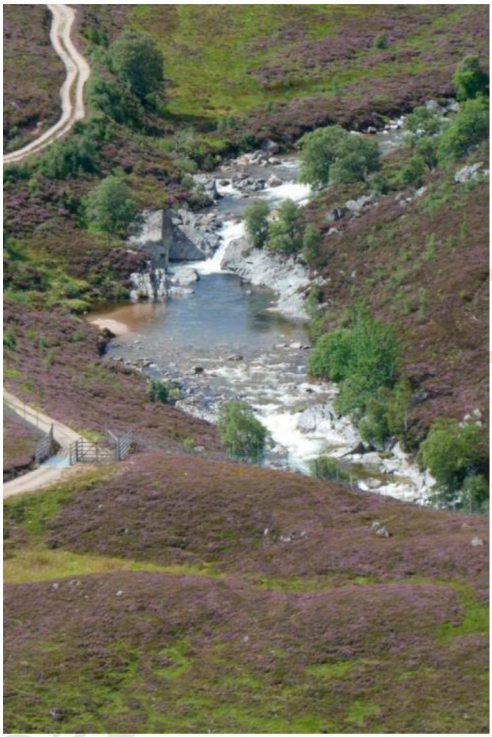

Fig 6. The Avon making its dramatic turn from the east to the north just above Inchrory. R. Jowett

Nor were these events confined to the main streams. Lying north-west of Inchrory is a system of tributaries of the ARDon, derived from the Water of Caiplich, which arises on the eastern flank of Bynack Mor. It courses east for 5 miles before turning suddenly north to become the Ailnack Water. (Figure 7, see next page). Its broad mature valley however continues east via Glen Loin to join the ARDon upstream of Inchrory. There is a dramatic gorge just below the elbow of the Caiplich/Ailnack (The Castle) which suggests a sudden event.

The diversion of the Caiplich into the Ailnack in this case may not have involved a glacial breach. There is evidence to suggest that above the elbow there developed a glacial lake due to stagnant ice in Glen

Loin, which burst through the northern boundary and caused the diversion. The event, sudden and catastrophic, was responsible for the

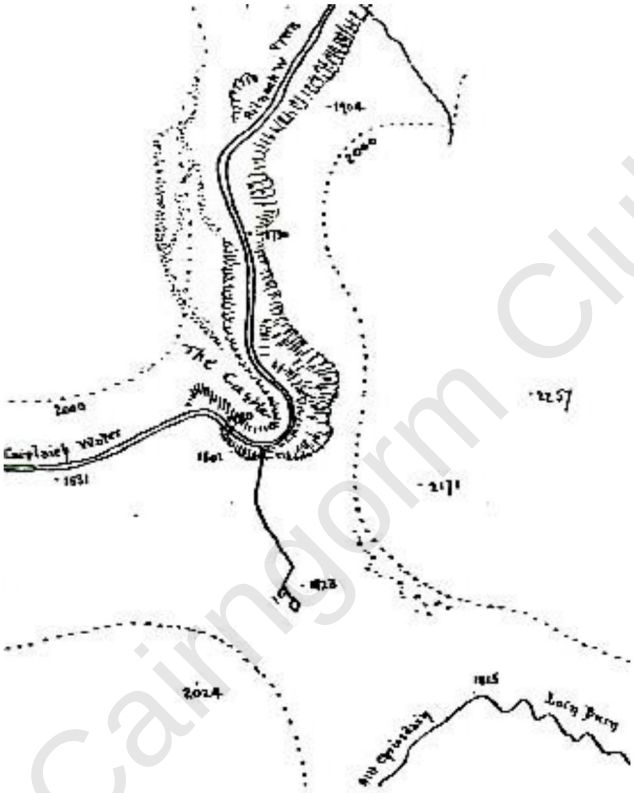

Fig 7. The diversion of the Caiplich Water into the Ailnack at the 'Castle'. From A. Bremner, 1912, The Physical Geology of the Dee Valley.

Loin, which burst through the northern boundary and caused the diversion. The event, sudden and catastrophic, was responsible for the Ailnack's Gorge below the 'Castle', a prominence on the west side, just at the bend. Thus, it is possible that this feature owes more to water than to ice – i.e. a meltwater channel. The upper Ailnack was originally a tributary of the Burn of Brown and it appears that sluggish progress of the ice down Glen Brown may have encouraged a glacial breach into today's lower Ailnack. It is thought that the torrential flow that followed the sudden drainage of the glacial loch in Glen Loin then exploited the channel formed previously by ice inundating the tiny

lower Ailnack and thus creating the dramatic gorge (Fig 8, see below) we see today before reaching the Avon.

The area of the Caiplich and upper Ailnack are still relatively unknown and those that do visit the gorge, usually only see the lower part. Nothing much has changed since a group of intrepid members traversed the gorge and continued via the Dagrum shoulder of Creag Mhòr to reach the Lairig an Laoigh and so down Glen Derry to Derry Lodge. Their exploits are recorded by William Garden in 1929 in the *Cairngorm Club Journal*.

Fig 8. The Ailnack Gorge looking south. Ben Avon with its tors can be seen in the distance.

A hundred years ago, the theories round 'river capture' owed much to the concept of 'headward erosion' whereby one river catchment nibbled its way backwards to intercept a neighbour. For many years it was thought that this process applied to the course changes of the ancient rivers of the Cairngorms. As I was preparing this article, I was reading round the subject as I travelled to Aberdeen by train, when a couple joined me. The lady commented that it had been many years since she had read the book in front of me and it turned out that they were both geomorphologists. I explained that I was struggling with river capture and the concept of head-ward erosion in the Cairngorms. We talked about the role of glaciation, his specialism. All too soon they

made to leave the train and as they took their leave, he said "It's all down to ice". Of course. Problem solved, for now.

I am grateful to Dr Brice Rea of the Department of Geography, University of Aberdeen, Dr Graham Smith of the British Geological Survey and to Drennan Watson for advice in the preparation of this article, and to the unidentified geomorphologists on that train.

[1] The Dalraidian was a geological epoch over 500 million years ago, characterised in this area by marine sediments altered by heat and pressure, i.e. metamorphosed.

Further Reading

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